

USER'S MANUAL

IRRIGATION CONTROLLER



“IRRIGATION AND FERTILIZATION CONTROL FOR AN ENTIRE FARM”

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1 THE MERIDIAN CONTROLLER

1.1 GENERAL FEATURES

- 6 Irrigation Pumps
- 1 Fertirrigation equipment with up to:
 - 5 fertilizer injectors
 - 1 acid injector
 - 3 injectors for other phytosanitary formulas
 - 6 counters/meters to feed products
 - 1 Mixing tank
- 1 general meter/counter
- 100 irrigation programs, that:
 - Can be stored in active or de-activated modes
 - Activation by schedule.
- 32 or 64 programmable outputs for system components
- Up to 16 digital and 16 analog inputs for:
 - Volumetric meters (/flow meters)
 - pH and EC measurement
- Different fertilization formulas
- Storage for the various daily event records
- Statistical reports
- Menu of programmable alarms
- Filter cleaning by schedule or by pressure differential

1.2 DESCRIPTION

MERIDIAN is a novel concept for irrigation and fertilizer management built around small-size electronic equipment. Although it was designed on the basis of more powerful equipment, such as **SUPRA** -and keeping their same characteristics-, its uses have been suited to more simple – though not less demanding- installations. This feature allows managing in a friendly and efficient way the various tasks of software programming, system configuration and report editing.

These advantages are possible by means of a microprocessor that is six to seven times more powerful than any other controller available in market. Comparatively, the storage system is even larger, with 16 MB standard storage –enough capacity to store several decades of statistical data- with expanding capacity to 32, 64 MB or more.

The user can operate the system by inputting commands on a 122 x 92 mm **Touch-Screen** that displays –among other things- the equipment’ present and past states, on-going tasks and menu options. This touch-screen feature, which facilitates a faster and more simple operation, has been selected from the most robust versions available, to conform into an equipment capable of withstanding the most severe environmental and working conditions.

The system has capacity to manage one complete irrigation and fertilization system, including all types of pumps, electric motors, valves, meters and counters, pressostates (pressure meters) and probes. All these elements are definable through their own PLC by entering the proper operation parameters for the programmed task.

1.3 INTRODUCTION

The equipment is mounted in *boxes, or mounted on a panel for automatic or manual control – this last one features the serigraphic layout of the farm installations.*



The in-box model has 32 outputs, 8 digital and 8 analog inputs. Through an Expansion Unit, the number of outputs/inputs can be expanded to 64 and 16/16, respectively.

The on-panel models can be ordered either with 32 or 64 outputs. This model is fit for the classic concept of FERTIRIEGO for installing the controller in a metal cabinet, along with the network protection system, failure and breakdown management system, reset press-buttons, switches, indicators and warning signs.

The indicators show the states of each output and the switches, their manual operation. Failure management can be executed automatically or manually, to act upon fuse blowups, maximum and/or minimum pressure, and an auxiliary mode.

These controls functions run independently from the controller, and their advantages are a better visualization and to ease the emergency operations.

The controller option with a Serigraphic layout plan displays a sketch of the installation and the irrigated area, showing the farm sectors and crops in different colours, and highlighting the ones under current irrigation.

MODELS AND TYPES			
INDIVIDUAL BOX	SIZE (cm)	VOLUME (m3)	WEIGHT (Kg.)
	30 W x 28 H x 14 D	0,012	4,50
AUTO / MANUAL BOARD WITH SERIGRAPHY	SIZE (cm)	VOLUME (m3)	WEIGHT (Kg.)
	60 W x 80 H x 50 D	0,12	30 - 35

1.4 USES

Models

- Housed in a plastic box (30 cm W x 28 cm H x 14 cm D)
- Housed in a metal cabinet (60 W x 50 H x 20 D cm). With auto/manual commands for each installed device
- Housed in a metal cabinet (80 H x 60 W x 25 D cm). With auto/manual commands for each installed device. Serigraphy layout plan of the farm.

Controller Versions

- Controller with 32 outputs, 8 analog and 8 digital inputs.
- Controller with 64 outputs, 16 analog and 16 digital inputs.

Display

- PC-type, graphical display (122 x 92 mm) featuring:
 - A layout diagram of the irrigation installation
 - Operative data
 - Entering commands for operational menus.
- **Touch-Screen** system for user-friendly operation

Programs

- It allows generating, editing and storing up to 100 different programs that show the following data:
 - Validity period between two dates
 - Days of the week the system is active
 - Starting time
 - Starting time for irrigation repetitions during the day
- Activated / inactivated Mode

Sectors

- The system can be configured for each sector by specifying:
 - Irrigation pumps
 - Field valves
 - Operational flow-rate
 - Operational pressure (rated pressure)

Commands

- 10 commands sequences per program, indicating:
 - Sector to be irrigated
 - Length of irrigation period
- Application parameters:
 - Fertilization
 - Other products (phitosanitary chemicals)
- Activation of AGITATORS:
 - ON Time before irrigation
 - ON/OFF Times during irrigation

Fertilization

- Injectors:
 - For up to 5 fertilizers
 - For up to 1 acid or base
 - For up to 3 phitosanitary products, with proportional injection
- Proportional volumetric method:
 - (L/m³) ratio for each injector
 - pH control with double probes, by setting the desired values
 - EC monitoring with a double probes for safety alarms
 - Flow rate (volume) metering readings for each injector
- Method of pH and EC Control:
 - Percentage-balanced (ratio-based) injection
 - PH control with double probes and by setting the desired value
 - EC control with double probe and by setting the desired value
 - Input EC control by incremental correction

Filter cleaning

- Programmed schedule (according to irrigation schedules or by independent schedule)
 - Length
 - Pauses
- According to pressure differential
 - Length
 - Pauses

Alarms

- **Electrical Conductivity EC:**
Control by comparing the obtained and desired values
Differential, by comparing two probes for a safer margin
- **pH:**
Control by comparing the obtained and desired values
Differential, by comparing two probes for a safer margin
- **Field valves:**
The system detects the excessive consumption (flow rate) of a valve
- **Maximum and minimum flow rates:**
It compares the nominal flow rate with the real one
- **Maximum and minimum pressures:**
It compares the readings of pressostates with that of the rated pressure
- **Levels:**
It detects any erroneous levels in tanks or vats
- **Parameters and actions:**
Tolerance margins
Persistence delays
Full or partial stops
Alarm warnings

Data Storage

- **Capacity:**
16 Mb —enough for many years of records.

Statistics

- **Report on all irrigation tasks, at any given date and time, indicating:**
Starting time
Irrigation length
Water volume
Ratio and/or volume of fertilizers
Volume of phytosanitary products
pH attained
EC obtained
Other parameters

2 INSTALLING THE EQUIPMENT

2.1 TECHNICAL DATA

2.1.1 POWER SOURCE		
Voltage:		230 VAC or 115 VAC (+5%; -10%) (for other voltage supplies, contact the manufacturer)
Frequency:		50-60 Hz
Load:		93 VA
Fuses	Input:	500 mA / 250 V
	Output:	2 A (only when using an internal transformer)
Storage maintenance (memory)		Clock: Battery 3.6 V – 80 mAH Data: Flash-type Memory

2.1.2 OUTPUTS		
	Number:	32
	Type:	By relay contact to a common point.
	Limits:	24 VAC maximum 2 A (internal transformer) Up to 48 AC/DC 5 A (external transformer)
Failure in the controller:	Number:	1
	Type:	By switch contact
	Limits:	250 VAC maximum 5 A
To expansion unit:	Number:	1
	Type:	RS-485
	Limits:	According to standards ANSI/TIA/EIA 485-A
All the outputs have double insulation respecting the supply mains		

2.1.3 INPUTS		
Digital inputs:	Number:	8
	Type:	Opto-coupled, operating with 12 VDC
	Limits:	Zero-voltage contact
Analog inputs:	Number:	8
	Type:	Individually selectable: Voltage 0-10 V Current 0-20 mA, 4-20 Ma
	Limits:	10 V or 20 mA
Breakdowns:	Number:	4, shared with digital ones 1 – 4.
	Type:	Opto-coupled, operating with 12VDC
	Limits:	Zero-voltage contact

2.1.4 ENVIRONMENTAL RANGES

Temperature:	0° C to 55° C
Humidity:	Less than 85 %
Altitude:	2000 meter maximum
Pollution rating:	Grade 2 maximum

2.1.5 OTHER DATA

Storage (Memory) duration:	Clock (over 5 years)
	Data (over 50 years)

2.1.6 INPUTS

Digital inputs:	Number:	8
	Type:	Opto-coupled, operating with 12 VDC
	Limits:	Zero-voltage contact
Analog inputs:	Number:	8
	Type:	Individually selectable: Voltage 0-10 V Current 0-20 mA, 4-20 Ma
	Limits:	10 V or 20 mA
Breakdowns:	Number:	4, shared with digital ones 1 – 4.
	Type:	Opto-coupled, operating with 12VDC
	Limits:	Zero-voltage contact

2.2 PLACEMENT

- Install the equipment at proper a height and position for an easy reach and comfortable operation.
- Avoid the direct sunrays, excess humidity, dust and vibrations.
- Avoid placement near other interference-generating devices (electrical noise pickup) in order to ensure a proper performance of the equipment.
- The cabinet should ensure a double insulation to protect the operator from electric shock hazards.
- If the programming equipment is installed close to heat-producing devices, or other equipment that could cause a temperature rise over 55°C (131°F), there should be a proper clearance between the programmer and these heat sources.

2.3 WIRING

- In the plug-in, panel model, the wiring is done through the connectors on the controller's back.
- In the water-proof model, the connectors are protected by a cover.
- To connect the cables, remove the corresponding connector caps
- **All wiring and installation procedures should meet the corresponding official standards for electrical installations. The irrigation control equipment will not be safe unless a strict compliance with this manual's specifications is met.**
- The unit should be installed in a way that the wiring of devices prone to picking up electrical noise is routed accordingly, trying to avoid all the interference from electricity-powered machines and apparel.
- All connectors are plug-in type, which allows for an easy maintenance task.

2.4 POWER SOURCE

- The water-proof model is powered by a standard 230VAC supply. 115 VAC can also be implemented upon previous request to FERTIRIEGO
- ***Both a magnetic-thermal switch (relay) rated 6A or greater, and a differential switch of 30mA sensibility, should be incorporated as a switch-off safety assembly. It should be installed close to the controller, at an easy-to-reach position.***

- All wiring should be routed as straightforwardly as possible. Avoid sharing cables for power supply; i.e. individual cables should feed single devices. Use 1.5 mm², HO5VV-F type cable.
- Power supply input from mains should be protected with a properly-rated fuse.
- For fluctuating or rippled voltages, incorporate a voltage stabilizer or –better still- a UPS (SAI)

2.5 DIGITAL INPUTS

- Contacts should always keep zero-voltage.
- Inputs are optically isolated from external circuits.

2.6 OUTPUTS

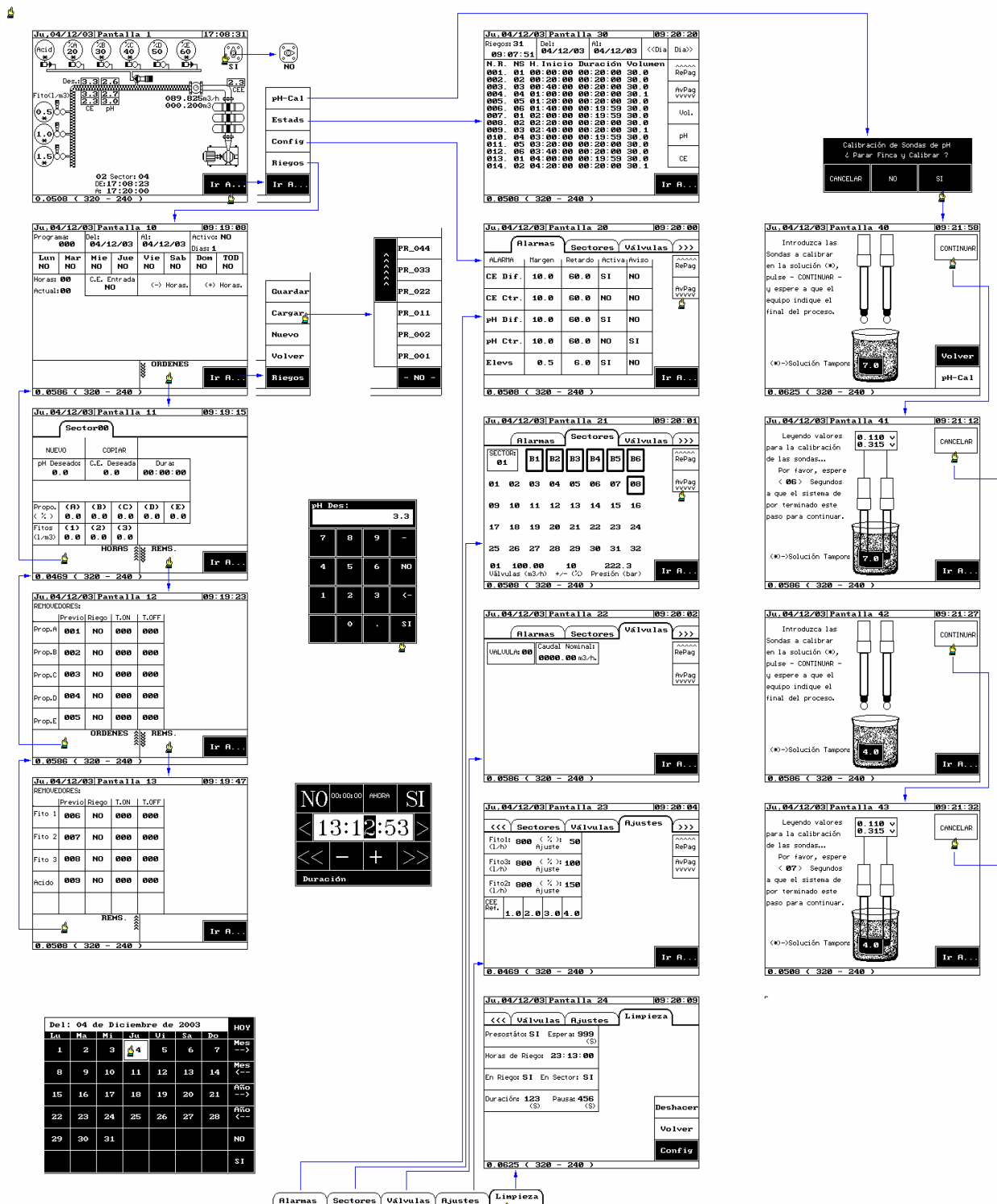
- All outputs are designed to operate with 24 VAC. DO NOT use feeding voltages greater than 48 VAC.
- Connect the solenoids, relays and other devices between the common terminal for outputs and the corresponding output.
- DO NOT surpass the maximum current limit of 1 A, and the general limit of 2 A in case of using an internal transformer, or 5 A for an external transformer.

2.7 SAFETY ADVICE

- Both the assembling and installation tasks should be performed by qualified personnel.
- The operational reliability and safety are warranted only if the equipment has been installed by following the conditions and instructions specified in the user's manual.
- Any other handling or diversion from specifications overrides all liability claims.
- The purchaser or any other user hereby agrees that Fertiriego Consorcio S.L. IS NOT liable from any and all hazard or damage caused by using this equipment.

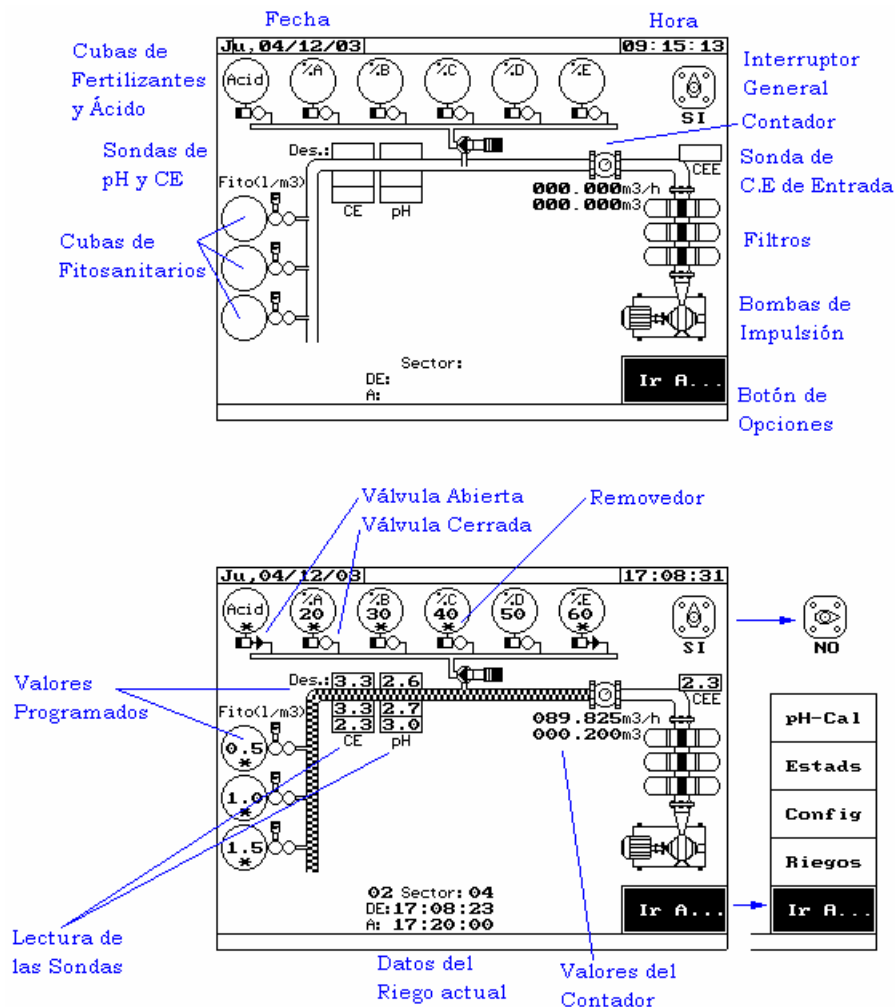
3 OPERATING THE EQUIPMENT

The following is a general layout scheme of the menus and display sets, altogether with the access routes for equipment configuration, programming, probes calibration, statistical records and other optional displays.



3.1 MAIN SCREEN

Upon switching on, a message will be displayed during few seconds to acknowledge the system setup. Then, the main screen will appear.



The main screen shows a schematic diagram of the hydraulic installation that controls the impeller pumps, the filtering, fertilization and other systems. The date and time appear on the upper corners, whereas on the bottom ones, the warning and prompts messages.

The diagram shows the rows of fertilizer and acid vats, each row with its corresponding dosifier pump. An open valve is represented by an arrow. The number inside each vat is the programmed operative value. An additional sign appears when the corresponding AGITATOR is turned on.

The injection pump discharges the fertilizer into the each vat output line which is connected to the irrigation pipes. The current EC and pH values of the water are metered through probes on this line. Above these readings, the programmed (desired) values are shown as well.

Before this fertilizer injection step, the irrigation water is metered by a counter which displays the instant flow rate and the distributed water volume.

Previous steps include the readings of electrical conductivity of the water at the intake, the state of the filtering system and the impeller pump.

After fertilizer injection and probe readings, the phytosanitary products are injected from three different vats into the irrigation pipeline. The vats are columnated in the diagram, each one with its own pump and valve —when it corresponds— and AGITATOR.

When the system is irrigating, the lower central part of the screen will show the operating program and the current irrigation data, including the sector currently being irrigated with its starting/ending times.

The switch-like button on the upper right side shows the farm's operative state: **SI** if it is **ON**, **NO** if it is **OFF**. Use this button to change state. When the system is **OFF (NO)**, no system component can be activated. When irrigating, if **Parada Finca (Farm OFF)** is pressed, the irrigation task will be stopped.

3.2 MAIN MENU

A button on the lower right corner showing **Ir a ... (Go to ...)** can be used to go the **Menú Principal (Main Menu)**. From this menu, different task options can be selected, e.g. to calibrate the pH probes, to check the irrigation statistics, to configure the various working parameters of the equipment, to program the irrigation segments, and other tasks.

Each option deserves to be explained in a separate section in order to delve properly into the operation of the equipment. They have been designed for a simple and intuitive handling by the user, when doing the system's setup, tuning and control tasks.

3.3 IRRIGATION PROGRAMMING

3.3.1 PROGRAMS

A Program is made up of a set of Irrigation Commands (sequences) and their operative parameters. In order to enter the Irrigation Programming screen, press **Ir a...** on the Main Menu (Menú principal) and, from the options, choose the first one —**Riego (Irrigation)**— that will display the corresponding irrigation program screen.

Here the user can edit the Program Number (1 to 99) which will individualize the program at hand for loading or storing purposes. It can create and store up to 100 different programs, whether activated or not, as well as delete, change or edit any of them, among other tasks. The system will check the contents of any selected program, and will execute it at the proper scheduled time.

Ju. 04/12/03 Pantalla 10								09:19:08	
Programa: 000		Del: 04/12/03		Al: 04/12/03		Activo: NO			
						Dias: 1			
Lun NO	Mar NO	Mie NO	Jue NO	Vie NO	Sab NO	Dom NO	TOD NO		
Horas: 00		C.E. Entrada NO		(-) Horas.		(+) Horas.			
Actual: 00									
					ORDENES				
					Ir A...				
0.0586 (320 - 240)									

The date the program will be used appears on the center of the screen. The sign **Del: (Since / From)** is the date of starting validation and, correspondingly, **Al: (To:)** the ending date. The program will be operative only through this period, provided all the arranged (programmed) conditions are met.

The operative state of the program (ON/OFF) –operational/non-operational– is shown on the upper right corner. If not operative, it will not perform any irrigation, even when all the programmed conditions are met. This is a fast means to prevent that a program be put into operation, by cancelling it temporarily, without having to delete it from memory for a later use.

The days the program will be **ON/OFF** will be marked **SI/NO**. A program will irrigate only during the established period and on the selected days.

If the parameter **Conductividad Eléctrica de Entrada (CEE) –Electrical Conductivity at the Intake (CEE)–** is used as a reference for fertilizer injection tasks, it will be shown on its corresponding label box, by means of an increased value as a function of the CEE readings in the water intake. Otherwise the system will prompt an absolute value for the **desired EC (CE deseada)** for fertilizer injection control.

Within the scheduled dates and days of the week, the program will turn the system on (**Starting Time –Hora de Inicio**) during the proper day and hours, cyclically, with capacity for 12 cycles a day, and programmable intervals among cycles. The user can enter, change or delete programmed times by pressing the proper buttons (boxes). When the list shows several time-hours, the user may press the one s/he wants to modify or delete.

3.3.2 IRRIGATION COMMANDS

The lower part of the screen has two buttons (boxes). The right one states the **“COMMANDS” (“ORDENES”)** which lets enter the next screen that defines the irrigation pattern for each defined starting times.

Irrigation commands are sequences within a program; each sequence corresponds to a single irrigation sector. Just one command arises by default at any given time. To change the sector number touches the sector name box; a dialog box will appear for introducing the desired sector number. A likewise procedure should be followed to modify an existing sector number. To delete a command, choose **0** in the sector number.

To introduce additional commands, press **NUEVO (NEW)**, with values set in **0** (zero) and then edit each of them. To introduce additional commands, but with the values edited in the current command, press the box **COPIAR (COPY)**.

The user may introduce the **desired pH** or **EC** values (absolute or input-dependent values), the irrigation period (duration) for a sector, the fertilizer ratios and the volume of phytosanitary products to inject into the pipe, as a function of the total irrigation water volume.

Note 1: The totals from the addition of all sectors' irrigation times for a given program will be the total duration of such a program, and –in case of repeating a cycle- it will not last longer than the period from a starting time to the following one.

Note 2: If two or more programs are **ACTIVE** simultaneously, they can **NOT** be overlapped as regards irrigation periods. If this problem arises, the system will issue a warning sign at the same time that it stores the programs, thus avoiding such a risk from becoming.

3.3.3 AGITATORS

The bottom boxes allow returning to the previous screen (**HORAS- HOURS**) or to progress into the next one (**REM. –removedores- AGITATORS**)

Ju. 04/12/03 Pantalla 12					09:19:23	
REMOVEDORES:						
	Previo	Riego	T.ON	T.OFF		
Prop.A	001	NO	000	000		
Prop.B	002	NO	000	000		
Prop.C	003	NO	000	000		
Prop.D	004	NO	000	000		
Prop.E	005	NO	000	000		
ORDENES				↑ ↑ ↑ ↑ ↑	REMS.	
					Ir A...	
0.0586 (320 - 240)						

Each product injection unit can be connected to an independent **AGITATOR** which can be put into operation with various parameters. The total of **AGITATORS** has been divided into two screens. When the user needs a cyclical operation, s/he can input the ON/OFF periods in seconds. The **Previous Time (Tiempo Previo)** can be entered, when stirring is desired before starting the irrigation; or the option to operate (or not) the **AGITATOR During Irrigation (Durante el riego)** can be selected as well.

Ju. 04/12/03 Pantalla 13					09:19:47
REMOVEDORES:					
	Previo	Riego	T.ON	T.OFF	
Fito 1	006	NO	000	000	
Fito 2	007	NO	000	000	
Fito 3	008	NO	000	000	
Acido	009	NO	000	000	
REMS.					
0.0508 (320 - 240)					

Guardar
 Cargar
 Nuevo
 Volver
 Riegos

The program menu features the options to **Delete (Borrar)**, to **Load (Cargar)** and to **Store (Guardar)** programs; or to create a **New (Nuevo)** one, or to **Return (Volver)** to the main screen.

Upon having finished editing a program, it will be stored until the system requires it on the pre-established dates and times. When wishing to modify an existing program, it should be first loaded, then, the desired parameters are modified and, finally, it is stored. When storing an existing program, only the last copy will be saved.

3.4 CONFIGURATION

On the Main Menu, when choosing the Configuration option, the most common parameters capable of modifying the system setup can be entered. The user may ask the Software Installer for more complex configurations, who will be able to open the corresponding Configuration Software.

The operations of the system can be made flexible by changing these parameters, according to the needs of the time.

Ju. 04/12/03 Pantalla 20					09:20:00
Alarmas					
ALARMA	Margen	Retardo	Activa	Aviso	
CE Dif.	10.0	60.0	SI	NO	RePag
CE Ctr.	10.0	60.0	NO	NO	AvPag
pH Dif.	10.0	60.0	SI	NO	vvvvv
pH Ctr.	10.0	60.0	NO	SI	
Elevs	0.5	6.0	SI	NO	
					Ir A...
0.0508 (320 - 240)					

3.4.1 ALARMS

Ju, 11/12/03 Pantalla 20					12:33:19
Alarmas					Sectores Uálvulas >>>
ALARMA	Margen	Retardo	Activa	Aviso	RePag
Cd Max.	1000	86400	NO	SI	AvPag
Cd Min.	0.0	60.0	NO	NO	VVVVV
Pr Max.	0.5	5.0	SI	SI	
Pr Min.	0.5	4.0	NO	NO	
Nivel	0.5	3.0	SI	SI	
					Ir A...
0.0508 (256 - 256)					

On the first page, the operative state of each alarm can be specified. With boxes **RePag** (Return Page) and **AvPag** (Go to next Page), all the **Alarms** can be visualized and zapped. The first column states the alarm source:

- **EC Dif. and pH Dif.:** For safety reasons, two probes are used to gauge (in a differential way) the very sensitive and important parameters, as are the pH and EC values of the irrigation water. If the reading from one probe differs from that of the other, an alarm condition will arise.
- **EC Ctr. and pH Ctr.:** In this case, the real and desired values are compared in order to trigger an alarm in case the equipment does not reach the programmed settings.
- **Elevs.:** The equipment features a protective electrical system triggered by a high electrical load of field valves.
- **Cd Max. and Cd Min.:** (Caudal = Flow rate) By defining the nominal (rated) flow rate for each field valve, the equipment will feature a theoretical (desired) flow rate for each irrigation sector, that will be the total from adding all valve flow rates of said sector. By comparing this theoretical (target) value with the real one, the user may detect problems such as pipe system breaks, water leaks/losses (maximum flow rate), malfunctioning valves, obstructions (minimum flow rate)
- **Pr Max. and Pr Min.:** if the installation has pressostates available, they will detect any dangerous pressure levels and trigger the corresponding alarm.
- **Nivel:** (Level) An additional device can be incorporated to detect erroneous levels both at the pumps' intake and in the vats/tanks distributed through the system.

The next column to the right called **Margen** (Tolerance Margin) shows the tolerance margin established for each alarm, according to alarm type. EC and pH settings are absolute values. There is no use of introducing here the tolerance margins for flow rates, because they are given in percentages when configuring each sector. It is done likewise for pressure levels and other values, which can be stated only as YES/NO (SI/NO)

The column **Retardo (Delay)** sets the time in seconds to trigger the alarm, since the instant of problem detection. If it is set in zero, the alarm will be on instantaneously. For delayed alarms, it will be set off if the problem persists until reaching the delay period. If the problem disappears during said period, the alarm will not actuate.

The user can select “**Activa**” **SI** o **NO**, (Activated YES / NO) to make that each alarm stop (or not) the irrigation task. The column **Aviso (Warning)** shows whether the system has to warn —by the means available— that said alarm(s) is activated.

3.4.2 SECTORS

Ju. 04/12/03 Pantalla 21		09:20:01					
Alarmas		Sectores		Válvulas		>>>	
SECTOR:	01	B1	B2	B3	B4	B5	B6
01	02	03	04	05	06	07	08
09	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
01	100.00	10	222.3				
Válvulas (m3/h) +/- (%) Presión (bar)				Ir A...			
0.0508 (320 - 240)							

This screen presents each sector’s configuration. With it, the field valves can be associated to the impeller pumps, in order to define each sector to irrigate. The bottom part of the screen shows the total number of selected valves, the resulting nominal flow rate, the tolerance for these values for alarm triggering, and the nominal (rated) operational pressure.

To go to another sector, press the boxes “**RePág**” y “**AvPag**”—explained in a previous point-, or enter directly the sector number. The chosen elements will appear on a square; press your option to change this condition.

3.4.3 VALVES

Ju. 04/12/03 Pantalla 22		09:20:02					
Alarmas		Sectores		Válvulas		>>>	
VALVULA:	00	Caudal Nominal:		0000.00 m3/h.			
						RePag	
						AvPag	
						Ir A...	
0.0586 (320 - 240)							

On the **Valves (Válvulas)** screen, the rated (nominal) flow rate can be specified for each field valve, in order to control the instant-flow rate alarms –on the basis of the theoretically (target) defined rates.

3.4.4 CALIBRATION SETTINGS

Ju. 04/12/03 Pantalla 23		09:20:04	
<<< Sectores		Válvulas	Ajustes >>>
Fito1:	800 (l/h)	(%): 50	AAAA
		Ajuste	RePag
Fito3:	800 (l/h)	(%): 100	AvPag
		Ajuste	VVVVV
Fito2:	800 (l/h)	(%): 150	
		Ajuste	
CEE Ref.	1.0	2.0	3.0 4.0
			Ir A...
0.0469 (320 - 240)			

- **Phitosanitary Products:** The Rated (Nominal) Flow rate for each phitosanitary pump is shown, along with their operational percentage efficiency. If this efficiency (output) value changes physically in the pump's metering device, it will be shown on this screen to correct for a proper dosing.
- **Reference CEE Values;** Reference values are shown to control the irrigation water EC as a function of the current, real EC value in the pipe intake.

3.4.5 FILTER CLEANING

Ju. 04/12/03 Pantalla 24		09:20:09	
<<< Válvulas		Ajustes	Limpieza >>>
Presostato:	SI	Espera:	999 (S)
Horas de Riego:		23:13:00	
En Riego:	SI	En Sector:	SI
Duración:	123 (S)	Pausa:	456 (S)
			Deshacer
			Volver
			Config
0.0625 (320 - 240)			

The **Cleaning (Limpieza)** screen allows the user define the way of cleaning the various filters. This cleaning task can be performed by:

- **Pressure Differential**, based on the readings of two pressostates —one at the input and another at the output of each filter.
- **Irrigation Period**, based on the Irrigation Duration and Intermediate Pause for each filter cleaning.

In both cases, it can be indicated whether the cleaning may be done simultaneously (or not) with the irrigation, or if it has to wait until finishing the irrigation of a given sector.

By selecting **YES/NO (SI/NO)** from the various available options (**During Irrigation–En Riego-**, or **In Sector –En Sector-**) allows for different configurations among filter cleaning and their priority ranking, according to the running irrigation programs, as shown below:

DURING IRRIGATION	IN SECTOR	ACTION
SI (YES)	NO	The program will wait until the sector being irrigated is finished to start the filter cleaning task.
NO	NO	The program will wait until all programmed sectors had been irrigated to progress into to filter cleaning.
SI	SI	The program will progress into filter cleaning according to the conditions established by the user (presostate or irrigation time) regardless the programmed sector or sector sequence.
NO	SI	

3.5 STATISTICS

Ju. 04/12/03 Pantalla 30				09:20:20	
Riegos: 31	Del: 04/12/03	Al: 04/12/03	<<Dia	Dia>>	
09:07:51					
N.R.	NS	H. Inicio	Duración	Volumen	~~~~~
001.	01	00:00:00	00:20:00	30.0	RePag
002.	02	00:20:00	00:20:00	30.0	
003.	03	00:40:00	00:20:00	30.0	AvPag
004.	04	01:00:00	00:20:00	30.1	vvvvv
005.	05	01:20:00	00:20:00	30.0	
006.	06	01:40:00	00:19:59	30.0	Vol.
007.	01	02:00:00	00:19:59	30.0	
008.	02	02:20:00	00:20:00	30.0	
009.	03	02:40:00	00:20:00	30.1	pH
010.	04	03:00:00	00:19:59	30.0	
011.	05	03:20:00	00:20:00	30.0	
012.	06	03:40:00	00:20:00	30.0	CE
013.	01	04:00:00	00:19:59	30.0	
014.	02	04:20:00	00:20:00	30.1	
					Ir A...
0.0508 (320 - 240)					

On the Statistics screen, the user can check every irrigation operation with all the programmed data and real ones metered in each day. Any given day can be selected on the screen, indicating the number of irrigation cycles and mean totals. On each row, an irrigation cycle is shown, and the user can choose to check the values for **Volumen** (water volume), **pH**, **EC** and other parameters. The screen can scroll up/down for longer columns.

The system will store permanently all these data, even when no power is available. The capacity will depend on the number of irrigation cycles; but, in any case, this storage capacity is enough for several years. This useful feature for data checkups is crucial to verify the task and efficiency of the equipment, and to detect any probable anomaly.

This option has been conceived to let the user have a fast and simple panorama of every day's performance. If s/he wishes to delve into meticulous studies with these data, s/he can connect a PC to the MERIDIAN to unload these files and perform statistical operations for table and graphical reports, using market-available software, or the specifically dedicated one from FERTIRIEGO for such a purpose.

3.6 PROBE CALIBRATION

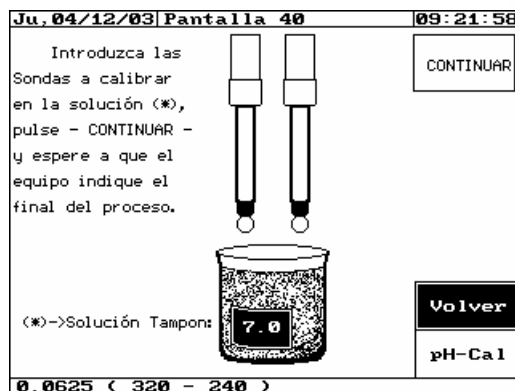
The pH probes installed in the equipment are of high-precision but they require a maintenance schedule to keep intact their characteristics during their life cycle. According to usage, they can be subject to chemical hazards that may alter their well-functioning features.

Any probe malfunctioning may affect the dosifier system and –therefore- the quality of the water supplied to the crops. Hence, it is necessary to re-calibrate the probes on a scheduled basis, according to their characteristics and usage of the irrigation installation.

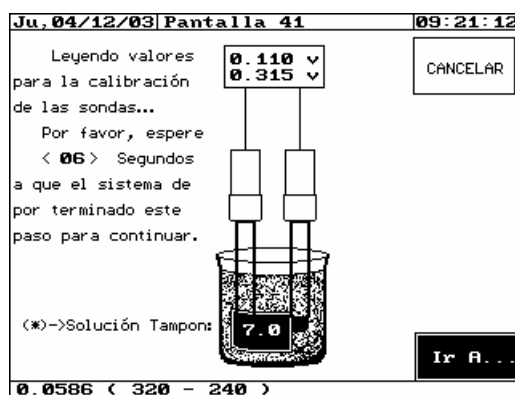
To calibrate a pH probe, the corresponding option is selected on the main screen. The system will then warn that the operation for the entire farm will be shut-off for probe calibration procedures. By answering positively to this prompt, the screen will show the steps and commands to perform the entire process.

The user has to follow this procedure each time a scheduled maintenance time is arrived at, or when deciding to substitute a probe. In this last case, calibrate both probes —even when substituting just one—; else, the values to be read will not be consistent.

The probes are removed from their placement in the water pipe system by shutting the corresponding shutoff valve, thus preventing any water leak through the probe housing during the calibration procedure. Have a clean glass container of a proper size to place both probes in buffer solution. The container should be filled with enough buffer solution as to cover the probes' transparent part, just above the middle of the probe length, approximately.

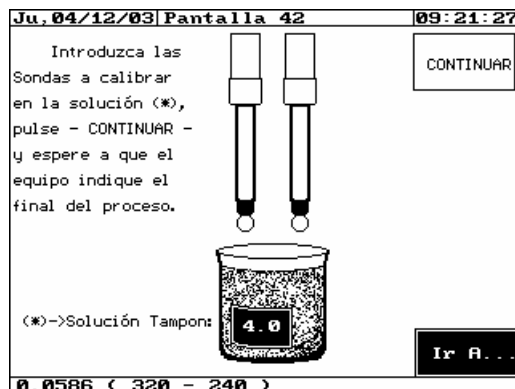


In the first place, the probes to be calibrated have to be placed into the buffer solution No. 7 labelled on the glass container. When the pH value of the solution to be used is different, change it on the screen and edit the new desired pH value.



After pressing **CONTINUAR** (CONTINUE) the system will beg reading during few seconds. The button will then be labelled as **CANCELAR** (CANCEL), so that this prompt can be used anytime it is necessary to stop the process. If it is not stopped, and after few seconds, the equipment will reach the necessary value and will issue a prompt to put the probes into another buffer solution.

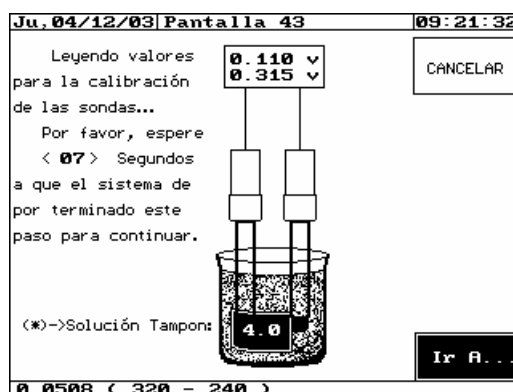
In this case, it means a buffer solution No. 4 that –likewise the previous solution- is the most standard one. Again, as remarked in the previous steps, this pH value can be changed as needed, and introduce the solution value currently being used or needed.



Remember that the precision of these values is critical for a later reading and control of pH levels during irrigation. Do not hesitate in repeating the procedure in case of noting any kind of anomaly, or when in doubt about the result attained.

When entering the buffer solution value, the user can introduce decimals if necessary. It is very important to follow the manufacturer guidelines and standards for correct probe cleaning, as well as for storing and keeping the buffer solutions.

The equipment will detect at all times every incorrect data and reading errors. It will issue a warning note about these occurrences, accordingly. The user should be sure about having done the proper steps, and that the electrical wiring and connections are working well.



In the figure, the upper part of the probes is signalled by a value in Volts –the present value read by each probe-. If these values differ much from each other, it is likely that one of them is off precision limits and coming out its useful life, thus indicating its substitution. This Volts value is expressed with an exaggerated accuracy; consequently, the last decimals will often oscillate –caused by the software in use—. If these decimals do not “oscillate” during the reading process, it means that such a reading is not correct. On the other hand, if this oscillation swings exaggeratedly, the odds are that some device is not working properly. At this point, the user should remember that between the controller and the probes there is an electronic device (interface) connected, and that it should be energized by a correct, well-operating source.

If, as expected, everything works fine, the equipment will store permanently the values that were set during the calibration process, and it will work with them until a new calibration procedure is started again.

The user should note on the main screen that the entire farm has been powered down to perform the calibration process. It should be powered on again in order to keep on controlling the tasks.

3.7 EDITING SYSTEMS

To edit values in a simple way, without introducing erroneous data, the equipment features a series of edition systems for a fast and intuitive edition. With this system, the equipment issues questions and prompts to the user, along with him corresponding messages for a fast comprehension.

3.7.1 CONFIRMATION MESSAGE

If a confirmation is needed to do a task or to communicate a specific event, the following frame will appear.

On the upper part of this dialog table, two text lines appear with the message and question the user has to answer. S/he has to press one of the three squares appearing on the bottom part (**CANCELAR** – **CANCEL**; **NO** and **SI**) according to the action to be performed.

Calibración de Sondas de pH ¿ Parar Finca y Calibrar ?		
CANCELAR	NO	SI

3.7.2 FRAME FOR VALUE EDITING

When needing to enter a numerical value, the equipment will show the corresponding dialog frame. On its upper part, a text message arises telling the value that is being edited currently.

In the next step, the previous value is shown, and it will be modified at the same time it is changed by the user. The number keyboard can thus be used as a hand-held calculator, correspondingly. This frame allows only introducing digits and decimals that the equipment needs at all time in order to prevent incorrect data.

pH Des: 3.3			
7	8	9	-
4	5	6	NO
1	2	3	<-
	0	.	SI

The box labelled **SI** will tell that the desired value has been already entered and that it needs that the equipment accepts it.

3.7.3 FRAME FOR HOUR-TIME EDITION

To introduce an hour-time value with the HH:MM:SS format, the time-edition window is used. The editing value is issued with a text message on the bottom. Four boxes are above this line; those labelled (<< and >>) help move the pointer on the central digits, where the value to edit is shown. Boxes + and – allow increasing/decreasing the digit reading to the selected value.

On the top line, the far right and left boxes (**SI** and **NO**) can be used to acknowledge or cancel the edited value. In the center, ‘00:00:00’ resets to zero the edited value, and **AHORA** (**NOW**) sets the same time as that of the equipment clock. This option is very useful when switching to program an irrigation that will be executed immediately, thus avoiding the steps of verifying the current time and change the digits to the exact number.

NO	00:00:00	AHORA	SI
<	13:12:53	>	
<<	–	+	>>
Duración			

3.7.4 FRAME FOR DATE EDITION

In this frame, the edition window shows a calendar that –besides helping the user prevent entering wrong data- is of great help to verify the irrigation days marked down in the very calendar.

The screen top shows the text message, followed by the current edited date. Below this, a monthly calendar leaf appears with number and days of the week.

Del: 04 de Diciembre de 2003							HOY
Lu	Ma	Mi	Ju	Vi	Sa	Do	
1	2	3	4	5	6	7	Mes -->
8	9	10	11	12	13	14	Mes <--
15	16	17	18	19	20	21	Año -->
22	23	24	25	26	27	28	Año <--
29	30	31					NO
							SI

By pressing correspondingly, the desired day will be highlighted with a different backlight colour, with the day indicated on the top line.

The user can both go back or advance months and years with the help of the right-side box, where there are **SI/NO** buttons as well. With these, the edited number can be confirmed or cancelled, as well as the rest of the frames for value edition.

All these operations for selecting on the dialog frames are performed with a simple press of the finger on the equipment's display. Any additional standard device can also be connected, e.g., a mouse or keyboard, without having to do any additional configuration procedure. .